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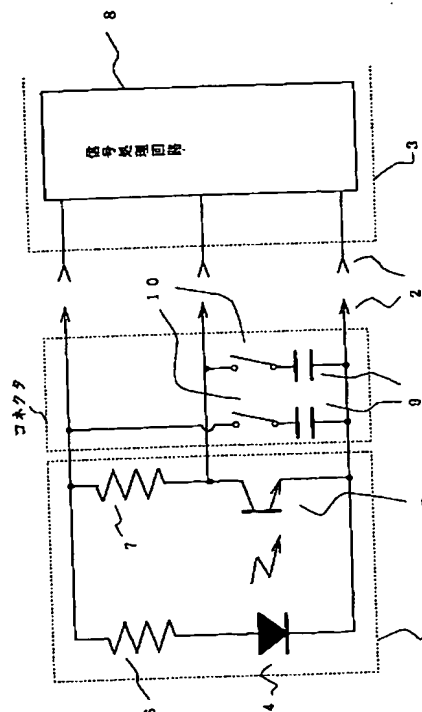
(54) 【発明の名称】 携帯用電子機器

(57) 【要約】

【目的】別体センサーの装着、非装着を問わず、静電気による計測機能の破壊を防止し信頼性の高い携帯用電子機器を提供すること。

【構成】別体センサー側コネクタ部に、発光ダイオード4とホトトランジスタ5を含む回路に並列にコンデンサ9を有する。さらに、このコンデンサの挿入、切り離しを行うスイッチ10を有する。そしてこのスイッチ10は、コネクタ端子2の摺動により、別体センサー非装着時にコンデンサ9を回路に接続し、別体センサー装着時には開放する。

【効果】特別な操作を必要とする事無く、別体センサーの静電気破壊の防止を可能とすることが可能となる。



【特許請求の範囲】

【請求項1】 電子機器本体とコネクタ端子により接続される別体センサーを有する携帯用電子機器において、前記別体センサーは少なくとも受光部を有する半導体素子を備えると共に、前記別体センサー側コネクタ部において、前記別体センサーの前記半導体素子を含む回路に並列にコンデンサーを配置し、さらに、前記コンデンサーの開放、接続を行うスイッチ手段を有することを特徴とする携帯用電子機器。

【請求項2】 前記スイッチ手段は、前記別体センサーを前記電子機器本体に非装着とした時に前記コンデンサーを前記別体センサー側の回路に接続し、前記別体センサーを前記電子機器本体に装着した時には開放することを特徴とする請求項1記載の携帯用電子機器。

【請求項3】 前記スイッチ手段は、前記別体センサー側のコネクタ端子を摺動させることにより、前記コンデンサーを開放、接続することを特徴とする請求項2記載の携帯用電子機器。

【請求項4】 前記スイッチ手段は、前記別体センサー側の磁気リードスイッチにより、前記コンデンサーを開放、接続することを特徴とする請求項2記載の携帯用電子機器。

【請求項5】 前記別体センサーの半導体素子に、並列にダイオードを接続することを特徴とする請求項1記載の携帯用電子機器。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、別体センサーと電子機器本体をコネクタ端子で接続する携帯用電子機器に関し、特に静電気による半導体素子の破壊を防止した別体センサの構成に関する。

【0002】

【従来の技術】指先あるいは耳たぶなどで、発光ダイオードから放射される光を生体組織内に入射し、その散乱光をホトトランジスタで受光する光電式脈波検出センサーを用い脈拍を測定する脈拍計や、半導体の温度特性を用いて温度を計測する温度計などはよく知られている。このような携帯用電子機器においては、脈拍・温度などの測定を行わない場合や異なった種類のセンサーを装着する場合などは、携帯性、機動性を高め汎用性を良くするために、センサー部を別体化し、コネクタ端子を介し電子機器本体との脱着を可能とすることは一般的である。

【0003】

【発明が解決しようとする課題】しかし、前述の別体センサーを電子機器本体より外しておいた場合、センサー回路内部の電子素子はコネクタ端子を介してむき出しの状態にある。このため、何らかの原因で静電気を帯びその放電が起きた場合、内部素子、特にホトトランジスタや発光ダイオードなどの半導体素子の静電気破壊がおき

やすいものであった。従って、従来の携帯用電子機器においては、信頼性が高く長寿命な別体センサーを実現するのは容易でなかった。

【0004】そこで、本発明は上記課題を解決するものであり、その目的とするところは、別体センサーの装着、非装着を問わず、如何なる環境下においても静電気による計測機能（半導体素子）の破壊を防止し、信頼性の高い別体センサー及び携帯用電子機器を提供することにある。

10 【0005】

【課題を解決するための手段】上記の目的を達成するために、本発明の携帯用電子機器は、電子機器本体とコネクタ端子により接続される別体センサーを有するものであって、別体センサーは少なくとも受光部を有する半導体素子を備えると共に、別体センサー側コネクタ部において、別体センサーの半導体素子を含む回路に並列にコンデンサーを配置し、さらに、コンデンサーの開放、接続を行うスイッチ手段を有することを特徴とする。

【0006】なお、スイッチ手段は、別体センサーを電子機器本体に非装着とした時にコンデンサーを別体センサー側の回路に接続し、別体センサーを電子機器本体に装着した時には開放することが望ましい。さらに、このスイッチ手段は、別体センサー側のコネクタ端子を摺動させることにより、コンデンサーを開放、接続すること、または、磁気リードスイッチにより開放、接続することがより望ましい。

【0007】また、別体センサーの半導体素子に、並列にダイオードを接続することが望ましい。

【0008】

【作用】さて、測定に影響を及ぼす静電気は、生体に装着したり携帯するような電子機器においては大きな問題である。すなわち、携帯性が高いと言うことは様々な静電気環境のもとにさらされることであり、中でも生体に装着するような場合には生体の動きによって発生する静電気によっても大きく影響されるからである。特に、腕や手に装着するような電子機器の場合は、衣服との間の摩擦による静電気や手と接触する部材による静電気などの影響が顕著であり、このような電子機器にとっては、耐静電気性は非常に重要な特性である。本発明は、別体センサーのコネクタ部に設置したコンデンサーとその接続・開放を選択することにより耐静電気性を大きく向上させたものであり、静電気の発生による影響が大きい環境において特に有用である。

【0009】請求項1、2記載の発明においては、別体センサーを本体から取り外した状態では、コネクタ部に設けたスイッチ機能によって、別体センサー側の半導体素子を含む回路に並列にコンデンサーが挿入される。これにより、静電気の放電が起こってもコンデンサーにより別体センサー回路全体の容量が増加しているため、瞬間的な過大な電荷移動を防止し静電気破壊を防止する。

特に、光電式の別体センサーにおける受発光素子であるホトトランジスタ、発光ダイオードは、静電気に弱いいため上記構成が非常に有効である。

【0010】また、脈拍や温度の測定時、別体センサーを本体に装着した場合は、上記スイッチ機能により、コンデンサーは回路より切り離される。これにより、脈拍測定時には脈信号の検出性の低下、駆動電力の低下等の悪影響を与えることがない。

【0011】請求項3記載の発明においては、コネクタの着脱の際の摺動動作がスイッチ動作になることにより、また、請求項4記載の発明においては、コネクタの着脱の際の磁力変化がスイッチ動作になることにより、別体センサーを本体から着脱する動作のみを行うことにより自動的にコンデンサーが接続・開放されるものである。

【0012】請求項5記載の発明においては、コンデンサーに加えて半導体素子にダイオードを接続することにより耐静電気性を一層高めたものである。

【0013】

【実施例】以下、本発明の一実施例について、図1、図2を用いて説明する。本実施例においては、脈波を検出するための携帯用電子機器とそのセンサー部を想定している。

【0014】図1は、本発明の携帯用電子機器の別体センサー部および本体コネクタ部の回路図である。別体センサー1は、コネクタ端子2を介して本体3の信号処理回路と接続される。別体センサー1は、光電検出方式の脈拍センサーであり、発光ダイオード4から放射される光を指尖等の生体組織内に入射し、その散乱光をホトトランジスタ5で受光するものである。

【0015】発光ダイオード4は、電流制限抵抗6と直列に接続され、電源によりバイアスされている。発光ダイオード4とホトトランジスタ5は、数ミリ隔てて配置されており指尖などの生体を軽くのせることにより、発光ダイオード4から発せられる光線が組織内の毛細血管等で散乱されてホトトランジスタ5に入射される。これにより、心臓から送られる血液による毛細血管の膨張、収縮に伴う入射光の変化は、ホトトランジスタ5に流れる光電流の変化となって検出される。

【0016】この光電流変化は、負荷抵抗7によって電圧の変化に変換され、本体3側の信号処理回路8に伝達される。信号処理回路8は脈波信号を弁別する低周波フィルター、増幅器と波形形成回路とからなり、脈拍パルス信号を出力する。この信号は、図示しない計数回路によって周期または周波数を測定され脈拍数に変換された上、表示手段により表示される。

【0017】また、本体3には、時計機能と脈拍測定結果のメモリーを有しており、別体センサー1を装着しない状態においても、携帯機器として使用できるものである。

【0018】しかしながら、別体センサー1を本体3から切り離した状態（脈拍非測定状態）において静電気を帯びた状態で、この別体センサー1を本体3に接続する場合または、衣類の着脱等により発生する静電気の放電が起こると、特に受発光素子であるホトトランジスタ、発光ダイオードは、静電気に弱いため、ホトトランジスタあるいは発光ダイオードの静電気破壊が起こる可能性が高い。

【0019】そこで、本発明においては以下に述べる方法で、静電気による別体センサー回路素子の破壊を防止する。図1に示すように、別体センサー1の回路毎（すなわち、発光ダイオード4を含む回路とホトトランジスタ5を含む回路）に並列にコンデンサー9を挿入する。更にこのコンデンサー9はスイッチ10を介して回路に接続される。

【0020】別体センサー非装着時（脈拍を計測しない場合）は、スイッチ10は閉じられており、コンデンサー9は別体センサー1の回路毎並列に接続されている。この状態において、静電気が放電されても、コンデンサー9による別体センサー回路全体の容量が増加しているため、瞬間的な過大な電荷移動を防止し、静電気破壊を防止する。特に、受発光素子であるホトトランジスタ、発光ダイオードは構造上、他の回路素子に比べ静電気に弱い静電気対策が重要である。

【0021】脈拍測定時（別体センサー1を本体3へ接続する場合）は、先ずスイッチ10を閉じた状態で、別体センサー側コネクタ端子は本体側コネクタ端子と接続され、非装着時と同様に、コンデンサー9を回路に並列に接続した状態で静電気が本体側へ放電され静電気による破壊を防止する。更に、コネクタ端子を接続した状態で、スイッチ10を開放して、コンデンサー9を切り離す。これにより、脈信号の検出性の低下、駆動電力の低下等の悪影響を与えることなく、別体センサー1は、生体組織内の血流変化を検出し、脈拍の測定が可能となる。

【0022】前記別体センサー1の静電気破壊の防止方法を実現する本発明の実施例に使用する別体センサー側のコネクタの構造を図2に示す。

【0023】コネクタの端子11、12、13は、導電性の導通バネ14、15、16を介し、ケース17により支持されている。ケース17は上蓋と本体より成り、プラスチック等の絶縁材で形成され、回路ブロック18と中空リング状の導通板19、20とを絶縁する。導通バネ14、15、16は回路ブロック18のパターンに接続されており、別体センサー回路と端子11、12、13とを接続している。21は磁石であり、図示しない本体側コネクタ端子の磁性板により本体と接続される。

【0024】導通バネ14は、回路ブロック18上のパターン及びコンデンサー22を介し、リード端子24を経て、導通板19と接続されている。同様に、導通バネ

5

15もコンデンサ23を介し、リード端子25を経て導通板20と接続されている。

【0025】上記構造のコネクタ端子は、通常導通パネ14、15、16により押し上げられており、端子12、13は導通板19、20とそれぞれ接続している。

【0026】従って、この時、端子11と端子12は、導通パネ14、回路ブロック18、コンデンサ22、リード端子24及び導通板19を介して電氣的に接続されている。同様に、端子12もコンデンサ23を接続した状態で、端子13と接続されている。これは、図1

10においてスイッチ10が閉じた状態に対応する。
【0027】従って、この状態で別体センサーに帯電した静電気の放電が起こっても、コンデンサが回路に並列に接続されているため、前述した様に静電気破壊を防止する。

【0028】また、脈拍測定を行う場合において、別体センサーと本体を接続する際は、上記の様に端子11、12、13が導通パネ14、15、16により押し上げられた状態（スイッチ10が閉じた状態で、コンデンサが並列に接続された状態）で、先ず端子11、12、13が、本体側コネクタ端子と接続し、静電気の放電が起こる。従って、上記と同様に別体センサーの静電気破壊を防止する。

【0029】次に別体センサー側コネクタ端子は、磁石21と図示しない本体側の磁性板により接続される。この時、端子11、12、13は本体側コネクタ端子により押し込まれ、導通パネ14、15、16が圧縮される。これにより、導通板19、20と端子12、13が離れ、コンデンサ22、23は回路より切り離される。これは図1において、スイッチ10が開放された状態に対応し、脈拍測定が可能な状態となる。

【0030】次に、脈拍測定を終了し、別体センサーを取り外すと、導通パネ14、15、16の作用により、端子11、12、13は通常的位置に戻され、再び導通板19、20と接触し、図1のスイッチ10がONの状態、つまりコンデンサ22、23を接続した状態になり、静電気破壊防止機能を持つようになる。

【0031】次に、本発明の他の実施例について、図3を用いて説明する。図3は、上述した実施例の携帯用電子機器の別体センサーコネクタ部の縦断面図である。

【0032】基本的な構造は上述の実施例と回路も含めて同一であるが、コネクタ内部に磁気リードスイッチ27を有する。磁気リードスイッチ27の片側は、リード線29、回路ブロック18のパターンを経て、導通パネ14と接続している。また、もう一方は、リード線29、回路ブロック18のパターンを介しコンデンサ22に接続され、更に、回路ブロック18のパターンを経て導通パネ15に接続している。従って、端子11と端子12は、磁気リードスイッチ27、コンデンサ22を経て接続している。同様に、端子12と端子13も、磁気

6

リードスイッチ28、コンデンサ23を経て接続されている。

【0033】別体センサーを取り外した状態では、磁石21の漏れ磁束により、磁気リードスイッチ27、28は閉じた状態になり、コンデンサ22、23は回路に電氣的に接続される。これは、図1のスイッチの閉じた状態に対応し、静電気破壊を防止する状態である。

【0034】また、別体センサー装着時は、図示しない本体側の磁性板と、磁石21の磁力により別体センサーは固定される。この場合、磁石21の漏れ磁束が無くなり、磁気リードスイッチが開き、コンデンサコンデンサ22、23は回路より切り放され、脈拍測定が可能な状態になる。

【0035】次に本発明の実施例の応用例について、図4を用いて説明する。

【0036】図4は、上述した実施例の携帯用電子機器の別体センサー部および本体コネクタ部の回路図である。基本回路は上述した実施例の回路と同一であるが、発光ダイオード4に並列かつ極性を逆にしダイオード26を接続する。また、同様に受光素子であるホトトランジスタについても、図4の様にダイオード26を並列に接続する。他の回路およびコネクタ部の構造は上述した実施例と同じである。

【0037】別体センサー非装着時は、上述した実施例と同様にスイッチ10は閉じられており、コンデンサ9は回路毎、並列に接続されている。

【0038】この状態で衣類の着脱等により静電気の放電が起こった場合、静電気はコンデンサ9に一時蓄えられる。次に、このコンデンサ9に蓄えられた静電気は、別体センサーの素子を介して放電される。この時、コンデンサ9により別体センサー回路全体の容量が増加しているため、瞬間的な過大な電荷移動を防止し、静電気破壊を防止する。更に、前述の受発光素子に並列に接続されたダイオード26の整流作用により、静電気に特に弱い受発光素子の発光ダイオードおよびホトトランジスタへ過大逆電流が流れるのを防止できる。この過大逆電流の防止により、センサー素子の静電気破壊防止を確実なものにすることが可能となる。

【0039】脈拍測定時は、実施例1と同様にスイッチ10を開放して、コンデンサ9を切り離す。これにより、脈信号の検出性の低下、駆動電力の低下等の悪影響を与えることなく、別体センサー1は、生体組織内の血流変化を検出し、脈拍の測定が可能となる。

【0040】なお、本実施例においては、別体センサーに発光ダイオードを使用したのが、この発光ダイオードを用いなくても脈波の検出は可能である。すなわち、太陽光や電灯などの外光を利用してこの散乱光をホトトランジスタで検出するようにしてもよい。この場合は、静電気から保護する必要のある素子は受光素子であるホトトランジスタだけでよくなるので、別体センサーの構成が

単純になる。

【0041】また、本実施例においては、別体センサーには発光ダイオードとホトトランジスタしか記載していないが、これら以外にも様々な回路を付加することができる。その一例としては、サーミスタ等を用いた温度測定回路、結露センサー等を用いた湿度測定回路、センサーと生体との圧力を測定する圧力センサー回路、センサーなどに電源を供給する電源回路、センサーの状態などを表示する表示回路、などがあげられる。

【0042】さらに、本実施例においては、脈波を検出する携帯型電子機器について述べたがこれに限られるわけではない。例えば、半導体の感温特性を利用した温度計など、静電気に弱い半導体を別体センサーとして用いた電子機器であれば本発明を適用することが可能である。

【0043】

【発明の効果】以上述べたように本発明によれば以下のような効果を有する。

【0044】まず請求項1、2記載の発明によれば、別体センサーを有する携帯用電子機器において、別体センサーの静電気破壊の防止を可能とすることができると共に、センサー使用時（通常の測定時）における測定動作への影響をなくすことが可能となる。

【0045】請求項3、4記載の発明によれば、別体センサーを本体から着脱する動作のみを行うことにより自動的にコンデンサーが接続・開放されるので、特別な操作を必要とする事無く、静電気による破壊防止と通常の測定動作を両立させることができる。

【0046】請求項5記載の発明によれば、静電気による破壊の防止をより一層確実なものにすることができ

る。

【図面の簡単な説明】

【図1】本発明の携帯用電子機器の別体センサー及び電子機器本体コネクタ部の回路図。

【図2】本発明の別体センサーコネクタ部の縦断面図。

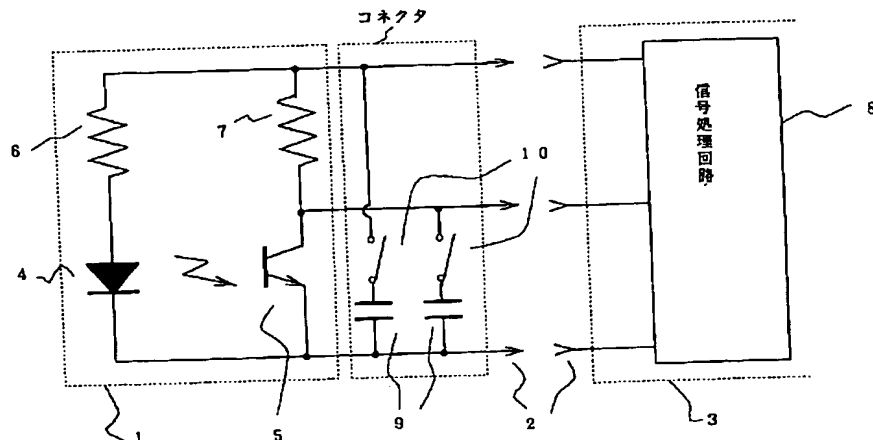
【図3】本発明の別体センサーコネクタ部の別の例を示す縦断面図。

【図4】本発明の別体センサー及び本体コネクタ部の応用例を示す回路図。

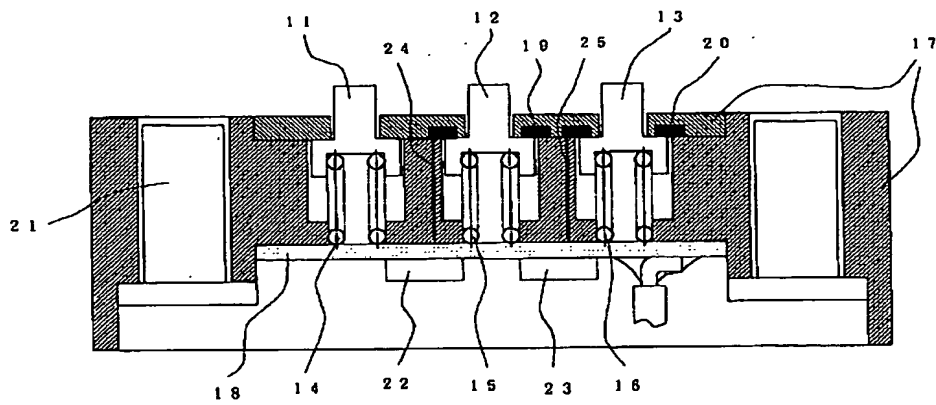
【符号の説明】

1. 別体センサー
2. コネクタ端子
3. 本体
4. 発光ダイオード
5. ホトトランジスタ
6. 電流制限抵抗
7. 負荷抵抗
8. 信号処理回路
9. 22. 23. コンデンサー
10. スイッチ
11. 12. 13. 端子
14. 15. 16. 導通パネ
17. ケース
18. 回路ブロック
19. 20. 導通板
21. 磁石
24. 25. リード端子
26. ダイオード
27. 28. 磁気リードスイッチ
29. 30. リード線

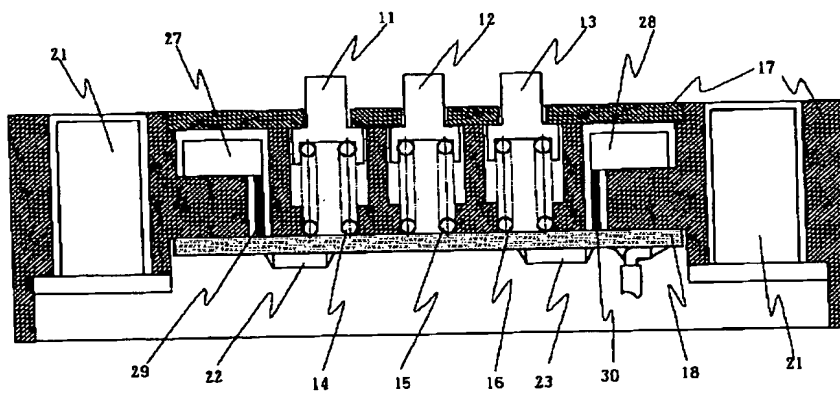
【図1】



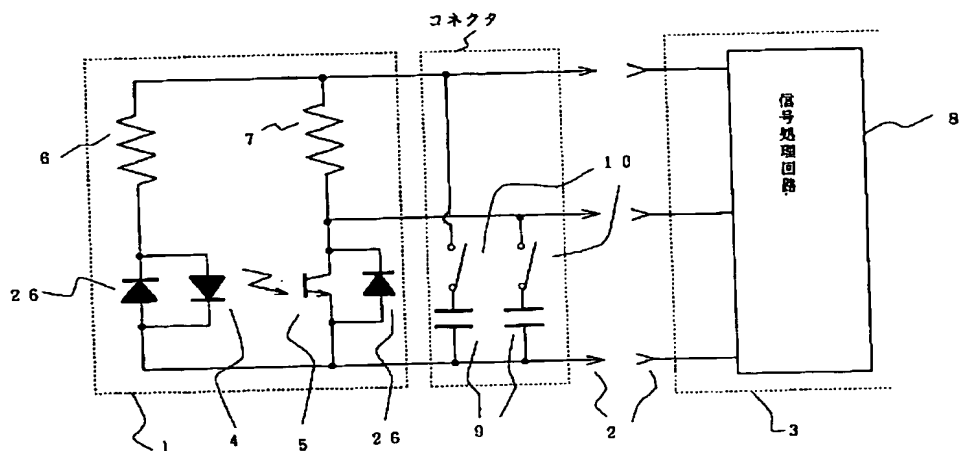
【図2】



【図3】



【図4】



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TECHNICAL FIELD

[Industrial Application] This invention relates to the configuration of another object sensor which prevented destruct of the semiconductor device especially by static electricity about the portable electronic device which connects the main part of electronic equipment with another object sensor with a connector terminal.

[Translation done.]

Translation of JP 08-243,284

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 PRIOR ART

[Description of the Prior Art] By the finger tip or the earlobe, incidence of the light emitted from a light emitting diode is carried out into a body tissue, and the pulsometer which measures a pulse using the photoelectrical type pulse wave detection sensor which receives the scattered light by the photo transistor, the thermometer which measures temperature using the temperature characteristic of a semiconductor are known well. since portability and mobility are raised and when equipping with the sensor of a different class when not measuring a pulse, temperature, etc. in such portable electronic device etc. improves versatility, it is common to form the sensor section into another object, and to boil desorption with the main part of electronic equipment as it is possible, and to carry out it through a connector terminal.

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EFFECT OF THE INVENTION

[Effect of the Invention] As stated above, according to this invention, it has the following effects.

[0044] While being able to enable prevention of the static electricity destruction of another object sensor in the portable electronic device which has another object sensor first according to invention of claim 1 and two publications, it becomes possible to lose the effect of the measurement actuation on [at the time of a sensor activity (at the time of the usual measurement)].

[0045] The destructive prevention by static electricity and the usual measurement actuation can be reconciled without needing special actuation, since a capacitor is automatically connected and opened by performing only actuation which detaches and attaches another object sensor from a main part according to invention of claim 3 and four publications

[0046] According to invention according to claim 5, prevention of destruction by static electricity can be made into a much more positive thing.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when the above-mentioned another object sensor is removed from the main part of electronic equipment, the electronic device inside a sensor circuit is in an unreserved condition through a connector terminal. For this reason, when it was electrified by a certain cause and that discharge broke out was what the static electricity destruction of semiconductor devices, such as an internal element especially a photo transistor, and light emitting diode, tends to set. Therefore, in the conventional portable electronic device, it was not easy to realize another object sensor with it. [it is reliable and long lasting]

[0004] Then, the place which this invention solves the above-mentioned technical problem, and is made into the object does not ask wearing of another object sensor and un-equipping, but prevents destruction of the measurement function (semiconductor device) by static electricity in the bottom of any environment, and is to offer reliable another object sensor and a reliable portable electronic device.

[Translation done.]

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MEANS

[Means for Solving the Problem] It is characterized by for a portable electronic device of this invention to have another object sensor connected with a main part of electronic equipment by connector terminal, in order to attain the above-mentioned object, and to arrange a capacitor at juxtaposition in a circuit which contains a semiconductor device of another object sensor in another object sensor side connector area while another object sensor is equipped with a semiconductor device which has a light sensing portion at least, and to have a switching means which makes disconnection of a capacitor, and connection further.

[0006] In addition, as for a switching means, opening is desirable when a capacitor is connected to a circuit by the side of another object sensor when [another object sensor / a main part of electronic equipment] un-equipping, and a main part of electronic equipment is equipped with another object sensor. Furthermore, as for this switching means, it is more desirable by sliding a connector terminal by the side of another object sensor to open and connect with to open capacitor and to connect or a magnetic reed switch.

[0007] Moreover, it is desirable to connect diode to juxtaposition at a semiconductor device of another object sensor

[Translation done.]

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 OPERATION

[Function] Now, static electricity which affects measurement is a big problem in electronic equipment which equips living body with or which is carried. That is, saying that portability is high is exposed to the basis of various static electricity environment, and it is because it is greatly influenced also by static electricity generated by motion of a living body when equipping a living body especially. Especially in the case of electronic equipment with which an a and a hand are equipped, the effect of static electricity by the member in contact with static electricity and the hand b friction between clothes etc. is remarkable, and the static electricity-proof nature is a very important property for suc electronic equipment. By choosing the capacitor installed in the connector area of another object sensor, and its connection and disconnection, this invention raises the static electricity-proof nature greatly, and its effect by generating of static electricity is useful especially in large environment.

[0009] In invention of claim 1 and two publications, where another object sensor is removed from a main part, a capacitor is inserted in juxtaposition by the switch function prepared in the connector area in the circuit containing th semiconductor device by the side of another object sensor. Since the capacity of the whole another object sensor circ is increasing by the capacitor by this even if discharge of static electricity takes place, momentary excessive charge transfer is prevented and the static electricity destruction is prevented. Since especially the photo transistor and light emitting diode that are a carrier light emitting device in photoelectrical-type another object sensor are weak to static electricity, its above-mentioned configuration is dramatically effective.

[0010] Moreover, when a main part is equipped with another object sensor at the time of measurement of a pulse or temperature, a capacitor is separated by the above-mentioned switch function from a circuit. This does not have adve effects, such as lowering of the detectability of a pulse signal, and lowering of actuation power, at the time of pulse measurement.

[0011] in invention according to claim 3, the sliding actuation in the case of attachment and detachment of a connect turns into switching -- moreover, in invention according to claim 4, when the magnetism change in the case of attachment and detachment of a connector becomes switching, a capacitor is automatically connected and opened by performing only actuation which detaches and attaches another object sensor from a main part.

[0012] In invention according to claim 5, the static electricity-proof nature is further raised by connecting diode to a semiconductor device in addition to a capacitor.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the configuration of another object sensor which prevented destruct of the semiconductor device especially by static electricity about the portable electronic device which connects the main part of electronic equipment with another object sensor with a connector terminal.

[0002]

[Description of the Prior Art] By the finger tip or the earlobe, incidence of the light emitted from a light emitting diode is carried out into a body tissue, and the pulsometer which measures a pulse using the photoelectrical type pulse wave detection sensor which receives the scattered light by the photo transistor, the thermometer which measures temperature using the temperature characteristic of a semiconductor are known well. Since portability and mobility are raised and when equipping with the sensor of a different class when not measuring a pulse, temperature, etc. in such portable electronic device etc. improves versatility, it is common to form the sensor section into another object, and to be disassembled with the main part of electronic equipment as it is possible, and to carry out it through a connector terminal.

[0003]

[Problem(s) to be Solved by the Invention] However, when the above-mentioned another object sensor is removed from the main part of electronic equipment, the electronic device inside a sensor circuit is in an unreserved condition through a connector terminal. For this reason, when it was electrified by a certain cause and that discharge broke out was what the static electricity destruction of semiconductor devices, such as an internal element especially a photo transistor, and light emitting diode, tends to set. Therefore, in the conventional portable electronic device, it was not easy to realize another object sensor with it. [it is reliable and long lasting]

[0004] Then, the place which this invention solves the above-mentioned technical problem, and is made into the object does not ask wearing of another object sensor and un-equipping, but prevents destruction of the measurement function (semiconductor device) by static electricity in the bottom of any environment, and is to offer reliable another object sensor and a reliable portable electronic device.

[0005]

[Means for Solving the Problem] It is characterized by for a portable electronic device of this invention to have another object sensor connected with a main part of electronic equipment by connector terminal, in order to attain the above-mentioned object, and to arrange a capacitor at juxtaposition in a circuit which contains a semiconductor device of another object sensor in another object sensor side connector area while another object sensor is equipped with a semiconductor device which has a light sensing portion at least, and to have a switching means which makes disconnection of a capacitor, and connection further.

[0006] In addition, as for a switching means, opening is desirable when a capacitor is connected to a circuit by the side of another object sensor when [another object sensor / a main part of electronic equipment] un-equipping, and a main part of electronic equipment is equipped with another object sensor. Furthermore, as for this switching means, it is more desirable by sliding a connector terminal by the side of another object sensor to open and connect with to open capacitor and to connect or a magnetic reed switch.

[0007] Moreover, it is desirable to connect diode to juxtaposition at a semiconductor device of another object sensor

[0008]

[Function] Now, static electricity which affects measurement is a big problem in electronic equipment which equips living body with or which is carried. That is, saying that portability is high is exposed to the basis of various static electricity environment, and it is because it is greatly influenced also by static electricity generated by motion of a

living body when equipping a living body especially. Especially in the case of electronic equipment with which an a and a hand are equipped, the effect of static electricity by the member in contact with static electricity and the hand b friction between clothes etc. is remarkable, and the static electricity-proof nature is a very important property for suc electronic equipment. By choosing the capacitor installed in the connector area of another object sensor, and its connection and disconnection, this invention raises the static electricity-proof nature greatly, and its effect by generating of static electricity is useful especially in large environment.

[0009] In invention of claim 1 and two publications, where another object sensor is removed from a main part, a capacitor is inserted in juxtaposition by the switch function prepared in the connector area in the circuit containing th semiconductor device by the side of another object sensor. Since the capacity of the whole another object sensor circ is increasing by the capacitor by this even if discharge of static electricity takes place, momentary excessive charge transfer is prevented and the static electricity destruction is prevented. Since especially the photo transistor and light emitting diode that are a carrier light emitting device in photoelectrical-type another object sensor are weak to static electricity, its above-mentioned configuration is dramatically effective.

[0010] Moreover, when a main part is equipped with another object sensor at the time of measurement of a pulse or temperature, a capacitor is separated by the above-mentioned switch function from a circuit. This does not have adve effects, such as lowering of the detectability of a pulse signal, and lowering of actuation power, at the time of pulse measurement.

[0011] in invention according to claim 3, the sliding actuation in the case of attachment and detachment of a connect turns into switching -- moreover, in invention according to claim 4, when the magnetism change in the case of attachment and detachment of a connector becomes switching, a capacitor is automatically connected and opened by performing only actuation which detaches and attaches another object sensor from a main part.

[0012] In invention according to claim 5, the static electricity-proof nature is further raised by connecting diode to a semiconductor device in addition to a capacitor.

[0013]

[Example] Hereafter, one example of this invention is explained using drawing 1 and drawing 2 . In this example, th portable electronic device and its sensor section for detecting a pulse wave are assumed.

[0014] Drawing 1 is the circuit diagram of another object sensor section of the portable electronic device of this invention, and a main part connector area. Another object sensor 1 is connected with the digital disposal circuit of a main part 3 through the connector terminal 2. Another object sensor 1 is a pulse sensor of a photoelectrical detection method, carries out incidence of the light emitted from light emitting diode 4 into body tissues, such as a finger tip, a receives the scattered light by the photo transistor 5.

[0015] It connects with the current-limiting resistance 6 and a serial, and bias of the light emitting diode 4 is carried by the power supply. By separating several mm, being arranged and picking up living bodies, such as a finger tip, lightly, the beams of light emitted from a light emitting diode 4 are scattered about by the capillary of an in-house etc and incidence of a light emitting diode 4 and the photo transistor 5 is carried out to a photo transistor 5. Thereby, change of the incident light accompanying expansion of the capillary by the blood sent from the heart and contractio turns into change of the photocurrent which flows to a photo transistor 5, and is detected.

[0016] This photocurrent change is changed into change of voltage by load resistance 7, and is transmitted to the dig disposal circuit 8 by the side of a main part 3. A digital disposal circuit 8 consists of the low frequency filter and amplifier which discriminate from a pulse wave signal, and a wave formation circuit, and outputs a pulse pulse signa This signal is displayed by the display means, after a period or frequency was measured and being changed into a pu rate by the counting circuit which is not illustrated.

[0017] Moreover, it has the memory of a clock function and a pulse measurement result on the main part 3, and can b used for it as a pocket device also in the condition of not equipping with another object sensor 1.

[0018] However, when discharge of static electricity generated by attachment and detachment of clothing etc. takes place in the condition of having been electrified in the condition (pulse condition of not measuring) of having separa another object sensor 1 from the main part 3 when connecting this another object sensor 1 to a main part 3 or, since i weak to static electricity, a possibility that the static electricity destruction of a photo transistor or a light emitting dio will take place is high [the photo transistor and light emitting diode which are especially a carrier light emitting device].

[0019] Then, it is the method described below in this invention, and destruction of another object sensor circuit elem by static electricity is prevented. As shown in drawing 1 , a capacitor 9 is inserted in juxtaposition for every (namely the circuit containing a light emitting diode 4 and the circuit containing a photo transistor 5) circuit of another object sensor 1. Furthermore, this capacitor 9 is connected to a circuit through a switch 10.

[0020] At the time of another object sensor un-equipping, the switch 10 is closed and the capacitor 9 is connected to juxtaposition the whole circuit of another object sensor 1 (when not measuring a pulse). In this condition, since the capacity of the whole another object sensor circuit by the capacitor 9 is increasing even if static electricity discharges momentary excessive charge transfer is prevented and the static electricity destruction is prevented. On structure, compared with other circuit elements, since it is weak to static electricity, as for especially the photo transistor and light emitting diode that are a carrier light emitting device, the cure against static electricity is important for it.

[0021] It connects with a main part side connector terminal, and like the time of un-equipping, where a capacitor 9 is connected to juxtaposition in a circuit, static electricity discharges to a main part side, at the time of pulse measurement, it is in the condition which closed the switch 10 first (when another object sensor 1 is connected to a main part 3), and another object sensor side connector terminal prevents destruction by static electricity. Furthermore where a connector terminal is connected, a switch 10 is opened and a capacitor 9 is separated. Thereby, without having adverse effects, such as lowering of the detectability of a pulse signal, and lowering of actuation power, another object sensor 1 detects the blood-flow change in a body tissue, and the measurement of a pulse of it is attained.

[0022] The structure of the connector by the side of another object sensor used for the example of this invention which realizes the prevention method of the static electricity destruction of said exception object sensor 1 is shown in draw 2.

[0023] The terminals 11, 12, and 13 of a connector are supported in the case 17 through the conductive flow springs 15, and 16. A case 17 consists of a top cover and a main part, is formed with insulating materials, such as plastics, and insulates the circuit block 18 and the hollow ring-like flow boards 19 and 20. It connects with the pattern of the circuit block 18, and the flow springs 14, 15, and 16 have connected another object sensor circuit and terminals 11, 12, and 21 is a magnet and is connected with a main part by the magnetic board of the main part side connector terminal which is not illustrated.

[0024] The flow spring 14 is connected with the flow board 19 through the lead terminal 24 through the pattern and capacitor 22 on the circuit block 18. Similarly, the flow spring 15 is also connected with the flow board 20 through the lead terminal 25 through the capacitor 23.

[0025] The connector terminal of the above-mentioned structure is usually pushed up with the flow springs 14, 15, 16, and terminals 12 and 13 are connected with the flow boards 19 and 20, respectively.

[0026] Therefore, the terminal 11 and the terminal 12 are electrically connected through the flow spring 14, the circuit block 18, the capacitor 22, the lead terminal 24, and the flow board 19 at this time. Similarly, after the terminal 12 has also connected the capacitor 23, it connects with the terminal 13. This corresponds to the condition that the switch 10 closed in drawing 1.

[0027] Therefore, since the capacitor is connected to juxtaposition in the circuit even if discharge of static electricity charged in another object sensor in this condition takes place, the static electricity destruction is prevented to the appearance mentioned above.

[0028] Moreover, when performing pulse measurement, in case a main part is connected with another object sensor, is in the condition (condition that are in the condition which the switch 10 closed and the capacitor was connected to juxtaposition) that terminals 11, 12, and 13 were pushed up with the flow springs 14, 15, and 16 as mentioned above and first, terminals 11, 12, and 13 connect with a main part side connector terminal, and discharge of static electricity takes place. Therefore, the static electricity destruction of another object sensor is prevented like the above.

[0029] Next, another object sensor side connector terminal is connected with a magnet 21 by the magnetic board by side of the main part which is not illustrated. At this time, terminals 11, 12, and 13 are pushed in with a main part side connector terminal, and the flow springs 14, 15, and 16 are compressed. Thereby, the flow boards 19 and 20 and terminals 12 and 13 separate, and capacitors 22 and 23 are separated from a circuit. In drawing 1, this corresponds to the condition that the switch 10 was opened, and will be in the condition in which pulse measurement is possible.

[0030] Next, when pulse measurement is ended and another object sensor is removed, according to an operation of the flow springs 14, 15, and 16, it will be returned to the usual location, the flow boards 19 and 20 will be contacted again, the switch 10 of drawing 1 will be in the condition of ON, i.e., the condition of having connected capacitors 22 and 23 and terminals 11, 12, and 13 come to have a static electricity destructive prevention function.

[0031] Next, other examples of this invention are explained using drawing 3. Drawing 3 is a drawing of longitudinal section of another object sensor connector area of the portable electronic device of the example mentioned above.

[0032] Also including an above-mentioned example and an above-mentioned circuit, although fundamental structure is the same, it has a magnetic reed switch 27 inside a connector. One side of a magnetic reed switch 27 has connected with the flow spring 14 through lead wire 29 and the pattern of the circuit block 18. Moreover, it is connected with the capacitor 22 through lead wire 29 and the pattern of the circuit block 18, and another side is further connected to the

flow spring 15 through the pattern of the circuit block 18. Therefore, the terminal 11 and the terminal 12 are connect through a magnetic reed switch 27 and a capacitor 22. Similarly, the terminal 12 and the terminal 13 are also connect through the magnetic reed switch 28 and the capacitor 23.

[0033] Where another object sensor is removed, magnetic reed switches 27 and 28 will be closed by the leakage flux a magnet 21, and capacitors 22 and 23 will be electrically connected to a circuit. This is in the condition of corresponding to the condition that the switch of drawing 1 closed, and preventing the static electricity destruction.

[0034] Moreover, another object sensor is fixed by the magnetic board by the side of the main part which does not illustrate at the time of another object sensor wearing, and the magnetism of a magnet 21. In this case, the leakage flu of a magnet 21 is lost, a magnetic reed switch is separated from a circuit and an aperture and the capacitor capacitors and 23 will be in the condition in which pulse measurement is possible.

[0035] Next, the application of the example of this invention is explained using drawing 4 .

[0036] Drawing 4 is the circuit diagram of another object sensor section of the portable electronic device of the example mentioned above, and a main part connector area. Although the basic circuit is the same as the circuit of the example mentioned above, juxtaposition and polarity are made into reverse and diode 26 is connected to light emittin diode 4. Moreover, diode 26 is connected to juxtaposition like drawing 4 also about the photo transistor which is a photo detector similarly. Other circuits and the structure of a connector area are the same as the example mentioned above.

[0037] Like the example which mentioned above at the time of another object sensor un-equipping, the switch 10 is closed and the capacitor 9 is connected to every circuit and juxtaposition.

[0038] When discharge of static electricity takes place by attachment and detachment of clothing etc. in this conditio static electricity is stored in a capacitor 9 temporarily. Next, static electricity stored in this capacitor 9 discharges through the element of another object sensor. Since the capacity of the whole another object sensor circuit is increasi by the capacitor 9 at this time, momentary excessive charge transfer is prevented and the static electricity destruction prevented. Furthermore, it can prevent that an excessive reverse current flows especially to static electricity to the lig emitting diode and photo transistor of a weak carrier light emitting device by the rectification of the diode 26 connec to the above-mentioned carrier light emitting device at juxtaposition. Prevention of this excessive reverse current enables it to make static electricity destructive prevention of a sensor element into a positive thing.

[0039] A switch 10 is opened like an example 1 at the time of pulse measurement, and it separates a capacitor 9. Thereby, without having adverse effects, such as lowering of the detectability of a pulse signal, and lowering of actuation power, another object sensor 1 detects the blood-flow change in a body tissue, and the measurement of a pulse of it is attained.

[0040] In addition, in this example, although light emitting diode was used for another object sensor, even if it does n use this light emitting diode, detection of a pulse wave is possible. That is, you may make it detect this scattered ligh by the photo transistor using outdoor daylight, such as sunlight and an electric lamp. In this case, since the element w the need of protecting from static electricity comes to require only the photo transistor that is a photo detector, the configuration of another object sensor becomes simple.

[0041] Moreover, in this example, although only the light emitting diode and the photo transistor are indicated in another object sensor, various circuits besides these can be added. The display circuit which displays the condition o the power circuit which supplies a power supply, and a sensor etc. on the hygrometry circuit using a thermometry circuit, a dew condensation sensor, etc. using the thermistor etc. as the example, the pressure-sensor circuit which measures the pressure of a sensor and a living body, a sensor, etc. is raised.

[0042] Furthermore, in this example, although the pocket mold electronic equipment which detects a pulse wave was described, it is not necessarily restricted to this. For example, if the thermometer using the temperature-sensitive property of a semiconductor etc. is electronic equipment using the semiconductor weak to static electricity as an another object sensor, it can apply this invention.

[0043]

[Effect of the Invention] As stated above, according to this invention, it has the following effects.

[0044] While being able to enable prevention of the static electricity destruction of another object sensor in the porta electronic device which has another object sensor first according to invention of claim 1 and two publications, it becomes possible to lose the effect of the measurement actuation on [at the time of a sensor activity (at the time of t usual measurement)].

[0045] The destructive prevention by static electricity and the usual measurement actuation can be reconciled without needing special actuation, since a capacitor is automatically connected and opened by performing only actuation whi detaches and attaches another object sensor from a main part according to invention of claim 3 and four publications

[0046] According to invention according to claim 5, prevention of destruction by static electricity can be made into a much more positive thing.

[Translation done.]

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 CLAIMS

[Claim(s)]

[Claim 1] It is the portable electronic device which arranges a capacitor at juxtaposition in a circuit which contains a semiconductor device of said exception object sensor in said exception object sensor side connector area, and is characterized by to have a switching means which makes disconnection of said capacitor, and connection further wh having a semiconductor device in which said exception object sensor has a light sensing portion at least in a portable electronic device which has another object sensor connected with a main part of electronic equipment by connector terminal.

[Claim 2] Said switching means is a portable electronic device according to claim 1 characterized by opening when said capacitor is connected to a circuit by the side of said exception object sensor when [said exception object senso said main part of electronic equipment] un-equipping, and said main part of electronic equipment is equipped with s exception object sensor.

[Claim 3] Said switching means is a portable electronic device according to claim 2 characterized by opening said capacitor and connecting by sliding a connector terminal by the side of said exception object sensor.

[Claim 4] Said switching means is a portable electronic device according to claim 2 characterized by opening said capacitor and connecting with a magnetic reed switch by the side of said exception object sensor.

[Claim 5] A portable electronic device according to claim 1 characterized by connecting diode to juxtaposition at a semiconductor device of said exception object sensor.

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EXAMPLE

[Example] Hereafter, one example of this invention is explained using drawing 1 and drawing 2. In this example, the portable electronic device and its sensor section for detecting a pulse wave are assumed.

[0014] Drawing 1 is the circuit diagram of another object sensor section of the portable electronic device of this invention, and a main part connector area. Another object sensor 1 is connected with the digital disposal circuit of a main part 3 through the connector terminal 2. Another object sensor 1 is a pulse sensor of a photoelectrical detection method, carries out incidence of the light emitted from light emitting diode 4 into body tissues, such as a finger tip, and receives the scattered light by the photo transistor 5.

[0015] It connects with the current-limiting resistance 6 and a serial, and bias of the light emitting diode 4 is carried by the power supply. By separating several mm, being arranged and picking up living bodies, such as a finger tip, lightly, the beams of light emitted from a light emitting diode 4 are scattered about by the capillary of an in-house etc and incidence of a light emitting diode 4 and the photo transistor 5 is carried out to a photo transistor 5. Thereby, change of the incident light accompanying expansion of the capillary by the blood sent from the heart and contraction turns into change of the photocurrent which flows to a photo transistor 5, and is detected.

[0016] This photocurrent change is changed into change of voltage by load resistance 7, and is transmitted to the digital disposal circuit 8 by the side of a main part 3. A digital disposal circuit 8 consists of the low frequency filter and amplifier which discriminate from a pulse wave signal, and a wave formation circuit, and outputs a pulse signal. This signal is displayed by the display means, after a period or frequency was measured and being changed into a pulse rate by the counting circuit which is not illustrated.

[0017] Moreover, it has the memory of a clock function and a pulse measurement result on the main part 3, and can be used for it as a pocket device also in the condition of not equipping with another object sensor 1.

[0018] However, when discharge of static electricity generated by attachment and detachment of clothing etc. takes place in the condition of having been electrified in the condition (pulse condition of not measuring) of having separated another object sensor 1 from the main part 3 when connecting this another object sensor 1 to a main part 3 or, since it is weak to static electricity, a possibility that the static electricity destruction of a photo transistor or a light emitting diode will take place is high [the photo transistor and light emitting diode which are especially a carrier light emitting device].

[0019] Then, it is the method described below in this invention, and destruction of another object sensor circuit element by static electricity is prevented. As shown in drawing 1, a capacitor 9 is inserted in juxtaposition for every (namely the circuit containing a light emitting diode 4 and the circuit containing a photo transistor 5) circuit of another object sensor 1. Furthermore, this capacitor 9 is connected to a circuit through a switch 10.

[0020] At the time of another object sensor un-equipping, the switch 10 is closed and the capacitor 9 is connected to juxtaposition the whole circuit of another object sensor 1 (when not measuring a pulse). In this condition, since the capacity of the whole another object sensor circuit by the capacitor 9 is increasing even if static electricity discharges momentary excessive charge transfer is prevented and the static electricity destruction is prevented. On structure, compared with other circuit elements, since it is weak to static electricity, as for especially the photo transistor and light emitting diode that are a carrier light emitting device, the cure against static electricity is important for it.

[0021] It connects with a main part side connector terminal, and like the time of un-equipping, where a capacitor 9 is connected to juxtaposition in a circuit, static electricity discharges to a main part side, at the time of pulse measurement, it is in the condition which closed the switch 10 first (when another object sensor 1 is connected to a main part 3), and another object sensor side connector terminal prevents destruction by static electricity. Furthermore where a connector terminal is connected, a switch 10 is opened and a capacitor 9 is separated. Thereby, without having adverse effects, such as lowering of the detectability of a pulse signal, and lowering of actuation power, another object

sensor 1 detects the blood-flow change in a body tissue, and the measurement of a pulse of it is attained.

[0022] The structure of the connector by the side of another object sensor used for the example of this invention which realizes the prevention method of the static electricity destruction of said exception object sensor 1 is shown in draw 2.

[0023] The terminals 11, 12, and 13 of a connector are supported in the case 17 through the conductive flow springs 15, and 16. A case 17 consists of a top cover and a main part, is formed with insulating materials, such as plastics, and insulates the circuit block 18 and the hollow ring-like flow boards 19 and 20. It connects with the pattern of the circuit block 18, and the flow springs 14, 15, and 16 have connected another object sensor circuit and terminals 11, 12, and 21 is a magnet and is connected with a main part by the magnetic board of the main part side connector terminal which is not illustrated.

[0024] The flow spring 14 is connected with the flow board 19 through the lead terminal 24 through the pattern and capacitor 22 on the circuit block 18. Similarly, the flow spring 15 is also connected with the flow board 20 through the lead terminal 25 through the capacitor 23.

[0025] The connector terminal of the above-mentioned structure is usually pushed up with the flow springs 14, 15, and 16, and terminals 12 and 13 are connected with the flow boards 19 and 20, respectively.

[0026]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The circuit diagram of another object sensor of the portable electronic device of this invention, and the main part connector area of electronic equipment.

[Drawing 2] Drawing of longitudinal section of another object sensor connector area of this invention.

[Drawing 3] Drawing of longitudinal section showing another example of another object sensor connector area of this invention.

[Drawing 4] The circuit diagram showing the application of another object sensor of this invention, and a main part connector area.

[Description of Notations]

1. Another Object Sensor
2. Connector Terminal
3. Main Part
4. Light Emitting Diode
5. Photo Transistor
6. Current-Limiting Resistance
7. Load Resistance
8. Digital Disposal Circuit
- 9.22.23. Capacitor
10. Switch
- 11.12.13. Terminal
- 14.15.16. Flow Spring
17. Case
18. Circuit Block
- 19.20. Flow Board
21. Magnet
- 24.25. Lead terminal
26. Diode 27.28. Magnetic Reed Switch
- 29.30. Lead wire

[Translation done.]

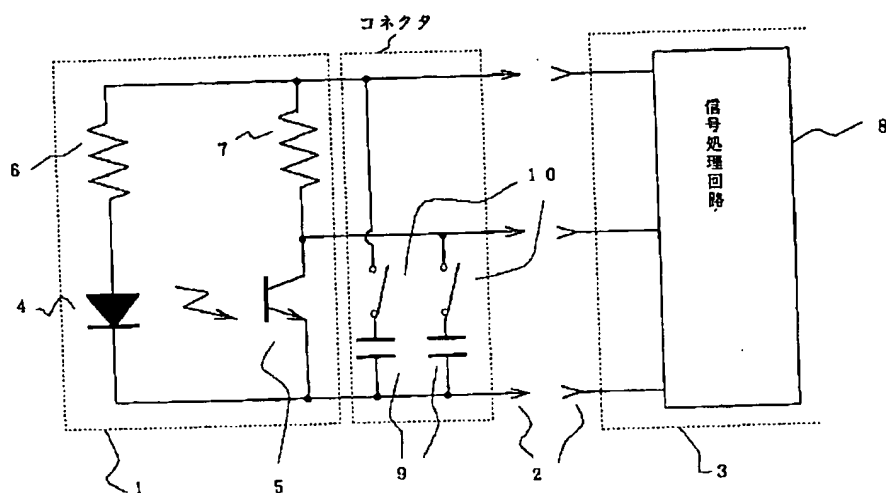
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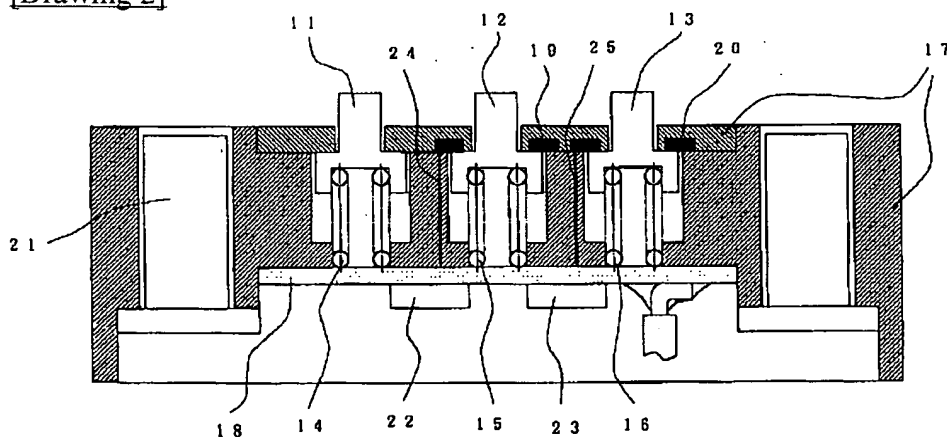
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DRAWINGS

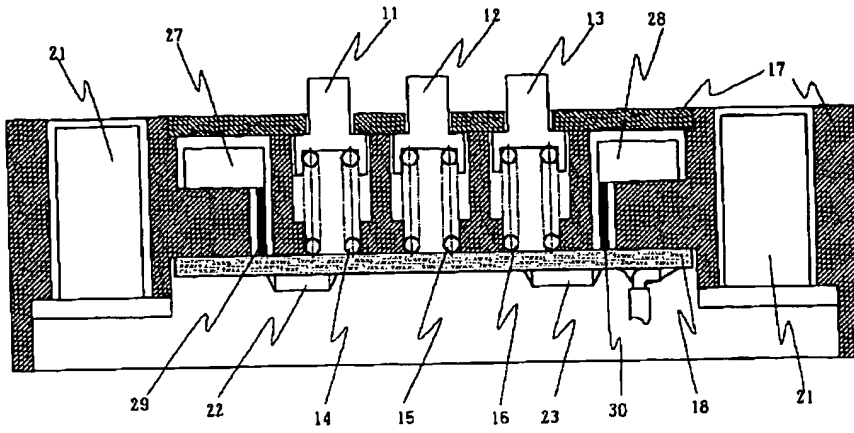
[Drawing 1]



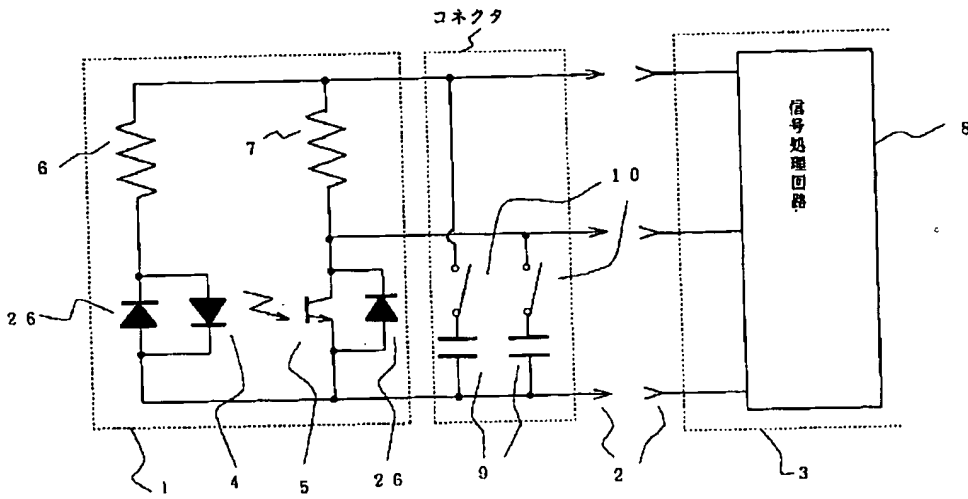
[Drawing 2]



[Drawing 3]



[Drawing 4]



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CORRECTION OR AMENDMENT

[Official Gazette Type] Printing of amendment by the convention of 2 of Article 17 of patent law

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A61B 5/02 G

[Procedure amendment]

[Filing Date] August 20, Heisei 13 (2001. 8.20)

[Procedure amendment 1]

[Document to be Amended] Description

[Item(s) to be Amended] 0032

[Method of Amendment] Modification

[Proposed Amendment]

[0032] Also including an above-mentioned example and an above-mentioned circuit, although fundamental structure the same, it has a magnetic reed switch 27 inside a connector. The terminal of one side of a magnetic reed switch 27 connected with the flow spring 14 through lead wire 29 and the pattern 3 of the circuit block 18. Moreover, although the graphic display was not carried out, it connected with lead wire, and it connected with the capacitor 22 through the pattern of the circuit block 18, and another terminal is further connected to the flow spring 15 through the pattern of circuit block 18. Therefore, the terminal 11 and the terminal 12 are connected through a magnetic reed switch 27 and capacitor 22. Similarly, the terminal 12 and the terminal 13 are also connected through the magnetic reed switch 28 a the capacitor 23.

[Procedure amendment 2]

[Document to be Amended] Description

[Item(s) to be Amended] 0033

[Method of Amendment] Modification

[Proposed Amendment]

[0033] Where another object sensor is removed, magnetic reed switches 27 and 28 will be electrically closed by the switch by the leakage flux of a magnet 21, respectively, and capacitors 22 and 23 will be electrically connected to a

circuit. This is in the condition of corresponding to the condition that the switch of drawing 1 closed, and preventing the static electricity destruction.

[Translation done.]